UNITED NATIONS

A

General Assembly

Distr.
GENERAL

A/AC.105/504
13 January 1992

ORIGINAL: ENGLISH

COMMITTEE ON THE PEACEFUL USES OF
OUTER SPACE

IMPLEMENTATION OF THE RECOMMENDATIONS OF THE SECOND UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

Report of the Secretariat in response to the request of the Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space

CONTENTS

	Paragraphs	Page
BACKGROUND	1 - 4	3
I. DOCUMENTATION RELATING TO THE IMPLEMENTATION OF THE RECOMMENDATIONS	5 - 8	4
II. SURVEY OF IMPLEMENTATION ACTIVITIES	9 - 30	5
A. Review of previous implementation studies	9 - 18	5
B. New information on implementation	19 - 25	7
C. Reassessment of the implementation of the recommendations	26 - 30	9
III. RECOMMENDATIONS EMERGING FROM FOLLOW-UP ACTIVITIES TO THE CONFERENCE	31 - 74	10
A. Short-term training	33 - 41	10
B. Long-term education	42 - 50	12

CONTENTS (continued)

		Paragraphs	Page
C.	Information, studies and technical advisory services	51 - 68	14
D.	Regional cooperation	69 - 74	18
IV.	CONCLUSIONS AND RECOMMENDATIONS	75 - 88	19

BACKGROUND

1. The Working Group of the Whole to Evaluate the Implementation of the Recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82), in its report on the work of its fifth session, requested the Secretariat to prepare a background paper to assist the Working Group in making a comprehensive assessment of the implementation of the recommendations of UNISPACE 82, taking into account previous reports already prepared by the Secretariat. 1/ The present report has been prepared by the Secretariat in response to that request.

2. The purpose of the present report is to provide the Working Group and the Scientific and Technical Subcommittee with an analytical review of international activities undertaken in implementation of the UNISPACE 82 recommendations, in particular the activities undertaken by the United Nations at the direction of the Committee on the Peaceful Uses of Outer Space and its subsidiary bodies. This review includes several sections: a survey of United Nations documentation on activities undertaken in response to the UNISPACE 82 recommendations; a brief summary of the previous analytical report on the implementation of the recommendations and a review of further implementation activities undertaken since that report; an analysis of the conclusions and recommendations by the United Nations space applications seminars, workshops and meetings of experts organized since UNISPACE 82; and a number of conclusions and recommendations based on those reviews and analyses.

3. Since UNISPACE 82, a great variety of space activities have been undertaken by the United Nations, by other international organizations and by Member States. Some of these activities, particularly those of the United Nations, have been undertaken specifically in response to the UNISPACE 82 recommendations and have been described in reports submitted to the Scientific and Technical Subcommittee. Most space activities, particularly those undertaken by States, were undertaken without explicit reference to UNISPACE 82 recommendations, but may have been influenced by that Conference and its follow-up activities. Since UNISPACE 82 was quite comprehensive in its recommendations, including many addressed to Member States and to international organizations other than the United Nations, many national and other international space activities correspond to those recommendations.

4. Given the enormous range of space activities since UNISPACE 82, the wide scope of the recommendations and the general nature of many of them, it is not possible to conduct a fully comprehensive assessment of the implementation of all of those recommendations. The present report will therefore concentrate on the implementation of the UNISPACE 82 recommendations by the United Nations. Other international space activities relating to the UNISPACE 82 recommendations will be reviewed briefly, and national space activities will be considered to the extent that they affect implementation by the United Nations of the recommendations.

I. DOCUMENTATION RELATING TO THE IMPLEMENTATION OF THE RECOMMENDATIONS

5. A large number of documents describing United Nations space-related activities and those of other international and national agencies have been submitted to the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee since UNISPACE 82. Some of those documents, mostly submitted by the Secretariat, describe activities with specific reference to particular UNISPACE 82 recommendations, while other documents either refer to UNISPACE 82 in general terms or describe activities without reference to the Conference.

6. In 1990, in response to a request from the Working Group of the Whole, the Secretariat prepared and submitted to the Working Group a broad overview of the implementation of the UNISPACE 82 recommendations that were addressed to the United Nations. 2/ In 1991, in response to a subsequent request from the Working Group, a review of actions taken by international organizations in response to the UNISPACE 82 recommendations was compiled and submitted to the Working Group. 3/ In addition, a brief annual update on the implementation of UNISPACE 82 recommendations by the United Nations has been submitted each year to the General Assembly, most recently at its forty-sixth session. 4/

7. Since 1982, and in response to the UNISPACE 82 recommendations, the United Nations Programme on Space Applications has organized each year from four to eight meetings on space applications for the benefit of people from developing countries, including training courses, seminars, workshops and meetings of experts. Reports on each of those meetings have been submitted to the Scientific and Technical Subcommittee. Also in response to UNISPACE 82 recommendations, the Programme administers fellowships for long-term education, provides technical advisory services to Member States on request, and provides information on recent developments in space technology and applications. A detailed summary of the activities of the Programme are provided in the annual reports of the Expert on Space Applications. A review of the Programme activities for 1991 and the planned activities for 1992 is contained in the most recent report of the Expert. 5/

8. Other international cooperative space activities undertaken by States and international organizations, including many activities corresponding to UNISPACE 82 recommendations, are described in the annual reports submitted by Member States and international organizations to the Committee. The most recent national reports are contained in document A/AC.105/505. Annual reports have been submitted by the International Telecommunication Union (ITU), 6/ the World Meteorological Organization (WMO), 7/ the Council on International Cooperation in the Study and Utilization of Outer Space (INTERCOSMOS), 8/ the International Telecommunications Satellite Organization (INTELSAT), 9/ the European Telecommunications Satellite Organization (EUTELSAT), 10/ the International Maritime Satellite Organization (INMARSAT) 11/ and the European Space Agency (ESA). 12/ In addition, annual reports on progress in space research are submitted by the Committee on

Scientific Research (COSPAR) of the International Council of Scientific Unions (ICSU), 13/ and annual reports on highlights in space technology and applications are submitted by the International Astronautical Federation (IAF). 14/

II. SURVEY OF IMPLEMENTATION ACTIVITIES

A. Review of previous implementation studies

9. The major report on the implementation of the UNISPACE 82 recommendations by the United Nations was the report prepared by the Secretariat and submitted to the Working Group of the Whole in 1990 2/ in reponse to the request of the Working Group at its previous session. That report consisted of a comprehensive review of the implementation of the UNISPACE 82 recommendations directed to the United Nations. The report also contained, in two annexes, lists of the UNISPACE 82 recommendations addressed to specialized agencies and to other international organizations.

10. A report on the implementation of UNISPACE 82 recommendations by specialized agencies and other international organizations, 3/ based on information received from those organizations, was submitted to the Working Group at its fifth session, in 1991, in response to the request made at its previous session.

11. The information in this section is a summary of the information in those two reports.

12. The report adopted by UNISPACE 82 15/ (A/CONF.101/10 and Corr.1 and 2) contained over 120 recommendations covering all aspects of space science, technology and applications. The report did not contain a separate list of recommendations, but integrated them together with the considerations, analysis and conclusions, with no indications as to the relative priority of any of the recommendations. The recommendations were summarized in document A/CONF.101/11. Some of the recommendations were explicitly addressed to the United Nations, to particular specialized agencies or to other specified international organizations, while other recommendations were addressed to States or were not explicitly addressed.

13. Some 42 of the UNISPACE 82 recommendations concerned activities to be undertaken by the United Nations; some 26 concerned activities to be undertaken by specialized agencies or other international organizations; and about 67 were recommendations addressed to Member States for their consideration.

14. As described in document A/AC.105/451, virtually all of the recommendations addressed to the United Nations have been implemented, at least in part. However, owing to the limited resources available to the United Nations for space applications activities, many of those recommendations have not been fully implemented. Furthermore, many of the

UNISPACE 82 recommendations called for ongoing activities, such as education and training, technical assistance, coordination and cooperative research, that could not in any case have been definitively implemented during the years that have elapsed since the Conference. The analysis thus indicated that full implementation of the UNISPACE 82 recommendations would require an expansion of the activities already being undertaken rather than the initiation of new types of activities in response to previously unimplemented recommendations.

15. As described in document A/AC.105/475, other elements of the United Nations system have made important contributions to the implementation of the UNISPACE 82 recommendations. Within the Secretariat, the Department of Technical Cooperation for Development has provided technical assistance in the applications of remote sensing to mapping, public works and infrastructure development. The Office of the United Nations Disaster Relief Coordinator (UNDRO) has been implementing a programme for using satellite communications and remote sensing for disaster relief, preparedness and prevention. The United Nations Environment Programme (UNEP) has been very active in promoting international cooperation and providing technical assistance in the applications of remote sensing to environmental monitoring. The United Nations Development Programme (UNDP) has provided financial support for development projects, including projects involving the applications of space technology.

16. As indicated in document A/AC.105/475, most of the specialized agencies of the United Nations system have undertaken studies, provided technical assistance and promoted international cooperation in the applications of space technology in their fields of specialization. The Food and Agriculture Organization of the United Nations (FAO), through its Remote Sensing Centre, has an extensive programme of technical assistance and training in the applications of remote sensing in the fields of agriculture, forestry and fisheries, is developing a remote-sensing information database and is using environmental satellite data for food security monitoring. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has conducted studies on the applications of satellite communication for education and development, has supported the feasibility study for the Regional African Satellite Communication System (RASCOM) and has organized education and training activities in remote sensing. The International Civil Aviation Organization (ICAO) is studying the use of satellite technology for improving air navigation and communication and will be coordinating the development of a new global air navigation system. ITU has continued to study the coordination of space communications and the use of the geostationary orbit and has supported the use of satellite communications for development, in particular through its participation in the RASCOM feasibility study. WMO has continued to study and promote cooperation in satellite meteorology, to ensure the free and open exchange of meteorological satellite data. The International Maritime Organization (IMO), in cooperation with other international organizations, has developed the global maritime distress and safety system (GMDSS) using satellite communications and has organized seminars to explain the system. The World Intellectual Property Organization (WIPO) has continued

to study the legal aspects of the transmission of programmes by satellites, particularly questions relating to copyright law.

17. As indicated in document A/AC.105/475/Add.1 and elsewhere, activities that implement the UNISPACE 82 recommendations, including technical assistance, education and training and information services, have also been undertaken by other international organizations including ESA, INTELSAT, INMARSAT, the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), EUTELSAT, COSPAR and IAF.

18. As indicated in the previous reviews and as summarized above, since UNISPACE 82 a large number and wide range of space-related activities corresponding to the UNISPACE 82 recommendations have been undertaken by the United Nations, the specialized agencies and other international organizations. Most of those efforts are continuing and many of them are expanding. Bearing in mind this diversity of space activities, the following sections of the present report will concentrate on the activities undertaken by the United Nations through its Programme on Space Applications.

B. New information on implementation

19. During the two years since the review contained in document A/AC.105/451, the activities undertaken by the United Nations in implementation of the UNISPACE 82 recommendations have generally followed along the lines described in that document. This section provides a brief summary of those activities to bring the previous review up to date. Further information on these activities is contained in the last two annual reports of the United Nations Expert on Space Applications. 16/, 5/

20. In the area of education and training, in 1990, one short training course and two workshops in the fields of remote sensing and satellite communications were organized under the United Nations Programme on Space Applications, and two other short-term training activities were co-sponsored and supported by the Programme. In 1991, three training courses and four workshops were organized under the Programme, in the fields of remote sensing, disaster relief and space science, and a seminar was co-sponsored and supported. In 1990, a total of 39 fellowships for long-term education were offered through the Programme, while in 1991, a total of 18 fellowships for long-term education were offered. The reduction was due to the unavailability of new fellowships following those previously offered by the then Union of Soviet Socialist Republics.

21. In accordance with the UNISPACE 82 recommendations emphasizing indigenous capabilities in developing countries, the United Nations Programme on Space Applications has been developing plans for the establishment of regional centres for space science and technology education in developing countries. Draft proposals have been developed and consultations are under way with funding agencies, the regional commissions, the specialized agencies, potential host countries and potential donor countries to examine ways to

implement the proposals in the different regions. The proposals and the consultations are summarized in document A/AC.105/498.

22. With respect to the international space information service that was recommended by UNISPACE 82, a study was submitted in 1991 on the economic aspects of strengthening and expanding national and regional data banks and establishing an international space information service as a coordinating centre. 17/ The second annual collection of selected papers from the seminars of the United Nations Programme on Space Applications, focusing on results in developing countries and including papers on remote sensing and satellite communications, 18/ was also submitted to the Scientific and Technical Subcommittee, and a list of experts in space technology and applications was submitted to the Committee at its 1991 session. The third collection of selected papers is to be submitted to the 1992 session of the Scientific and Technical Subcommittee. 19/ Work is under way on the preparation of updated versions of a number of directories of information on space activities for publication during 1992.

23. Additional technical studies have been carried out by the Outer Space Affairs Division in reponse to requests from the Working Group of the Whole. In 1991, two technical studies were submitted to the Scientific and Technical Subcommittee, a study on the applications of space technology to flood monitoring and control 20/ and a review of upper atmosphere studies for weather and environment monitoring, 21/ and a study on the spin-off benefits of space technology was submitted to the Committee. A study on the applications of space technology to integrated land and water resources management for rural development 22/ and a study on the applications of biomedical technology resulting from space life-science research 23/ are to be submitted to the Scientific and Technical Subcommittee in 1992. Additional studies are under way and will be submitted to the Scientific and Technical Subcommittee when they are available.

24. The Programme on Space Applications has also continued its efforts to provide technical advisory services upon request, particularly in support of regional cooperation among developing countries. Assistance has been provided for the organization of the Space Conference of the Americas held in 1990 in Costa Rica and for the follow-up activities. The Programme is also working with ESA to promote the use of remote-sensing data in African countries within range of the ESA ground stations, and with Ecuador to promote the use of the Cotopaxi ground station as a regional facility. Technical and organizational advice has also been provided to the Indian Ocean Marine Affairs Cooperation (IOMAC) programme in developing remote-sensing projects. The Expert on Space Applications participated in a mission that evaluated the organization and activities of the Regional Centre for Services in Surveying, Mapping and Remote Sensing in Nairobi and recommended ways to strengthen the Centre's ability to provide the services required by the region.

25. The Outer Space Affairs Division continued to coordinate its activities with those of the specialized and related agencies, in particular with FAO, UNEP, UNDP, UNDRO, WMO and the regional commissions. Among other

intergovernmental organizations, the United Nations has worked closely with, and received extensive support from, ESA, IAF and COSPAR. The United Nations has also received support from INTELSAT and INMARSAT.

C. Reassessment of the implementation of the recommendations

26. These recent activities reinforce the conclusion of the previous review of the implementation of the UNISPACE 82 recommendations that efforts have been made to implement, at least in part, all of the recommendations. The experience of the United Nations Programme on Space Applications also reinforces the conclusion that those activities are far from meeting the needs of the developing countries for assistance and cooperation to enable them to make full use of the potential of space applications for economic and social development. There is still a great need for education and training, for technical advisory services, for assistance in organizing regional activities, for access to the latest technology and applications developed in the advanced countries, and for the financial resources necessary for developing national space activities in developing countries.

27. While the general recommendations of UNISPACE 82 appear to be still valid, many of the more specific recommendations for particular studies or for the development or promotion of particular technologies have either been effectively implemented or have been bypassed by technological developments during the years since the Conference. In planning specific activities, therefore, the UNISPACE 82 recommendations often need to be updated to take account of recent developments.

28. The need to adapt the recommendations has been recognized, for example, in the technical studies that have been undertaken recently. Following the Conference, a number of the specific studies recommended by UNISPACE 82 were selected by the Committee on the Peaceful Uses of Outer Space to be carried out by the Outer Space Affairs Division on a priority basis, and other studies were carried out by other international organizations. 24/ When the Working Group of the Whole, in 1990, considered the question of further studies to be undertaken, it recommended a number of specific studies that were in accordance with the general UNISPACE 82 recommendations, but also reflected the views of the Working Group as to the priority questions as of 1990. 25/ Two of those studies were submitted to the Scientific and Technical Subcommittee in 1991, additional studies will be submitted in 1992 and the remaining studies are under way. There will need to be a periodic review of the priority topics for further studies that will be most useful to States, in particular the developing countries, in planning their space activities.

29. In the area of short-term training courses, workshops, seminars and meetings of experts, the UNISPACE 82 recommendations have also had to be adapted to meet the evolving requirements of States and the rapidly changing technologies and applications. In this case, guidance for planning the United Nations Programme on Space Applications has come from the annual reviews by the Scientific and Technical Subcommittee and from the activities themselves.

As part of the workshops, seminars and meetings of experts, the participants are requested to make recommendations for further activities for meeting the priority needs of their agencies and countries, and the recommendations are taken into account in planning the future activities of the Programme. In the following section, the conclusions and recommendations emerging from Programme activities since UNISPACE 82 are summarized as an indication of the current needs and priorities of developing countries.

30. It should be kept in mind that all of the activities of the United Nations Programme on Space Applications are largely or entirely dependent on voluntary contributions from Member States, a situation which places some limitations on the abilitity of the Programme to respond to specific recommendations and needs. None the less, the host and donor Governments and agencies have been very generous and flexible in organizing the activities to respond to the needs of developing countries, and the Programme has generally been able to respond to the UNISPACE 82 recommendations and to the needs and priorities as they have emerged from the activities since the Conference.

III. RECOMMENDATIONS EMERGING FROM FOLLOW-UP ACTIVITIES TO THE CONFERENCE

31. In order to assist the Scientific and Technical Subcommittee and its Working Group of the Whole in their consideration of ways to continue the implementation of the recommendations of UNISPACE 82, this section reviews and summarizes the recommendations of the workshops, seminars and meetings of experts of the United Nations Programme on Space Applications since UNISPACE 82. The recommendations have been analysed and summarized so as to reflect the evolving specific needs and priorities of the developing countries with respect to space science, technology and applications.

32. For this review, all of the recommendations of the meetings held as part of the United Nations Programme on Space Applications since UNISPACE 82 were compiled, categorized and summarized. The recommendations were categorized first by the type of activity, including short-term training, long-term education, information, studies and technical advisory services and regional cooperation. The recommendations in each of these categories were then analysed by technical area, including remote sensing, meteorology, oceanography, satellite communications and space science.

A. Short-term training

33. The recommendations relating to short-term training generally focused on the development of national capabilities in space science, technology and applications, including training for teachers, information for decision makers and specialized training for scientists and engineers on the latest developments in space science and technology. There was general agreement that there was a need for increased opportunities for people from developing

countries to participate in regional and international training courses, seminars and workshops. It was felt that the programmes of training activities should make use of the resources of both developed and developing countries and should focus on the adaptation of space technology and applications to the unique problems of the developing countries. It was also recommended that training activities should provide participants with material for demonstration, education and training at the national level.

34. It was recognized that international scientific and technical conferences provided valuable opportunities for people from developing countries to improve their knowledge of space science, technology and applications and to make contacts that could provide a basis of international cooperative projects. Taking into account the financial limitations on the space programmes of developing countries, there were recommendations that organizations sponsoring international conferences, training courses, symposia and workshops should waive registration fees for participants from developing countries.

35. In the area of remote sensing, the recommendations were for greater exchange of experience among educators and decision makers and for "hands-on" exercises in specific applications of remote sensing for scientists, engineers and technicians. It was also recognized, however, that for trainees to use the skills acquired at the training courses, they need material support from their Governments.

36. The recommendations with respect to priority topics for future specialized remote-sensing training courses covered a wide range of applications, including resource surveying and management, agriculture, forestry, geology and geophysics, soil sciences, water resources, hydrometeorology, agrometeorology, coastal zone surveying and management, oceanography and marine applications. Requirements were also identified for training in new satellite technologies including synthetic aperture radar, microwave systems and thermal infrared sensing.

37. Considering the large amount of data generated by existing and planned remote-sensing satellite systems, emphasis was also placed on data-handling technologies including geographic information systems (GIS), computer data handling for remote-sensing information banks and image-processing systems. On the organizational side, there were training requirements for programme management and project supervision.

38. There were also recommendations for training courses in the use of satellite meteorological and oceanographic information for the planning and development of maritime safety programmes and rescue facilities for maritime disasters. The development of an education curriculum on satellite meteorology was also recommended.

39. In the field of satellite communications, priority areas for specialized training included satellite and ground station technology and satellite network planning and development. The potential of satellite broadcasting for

regional and national development was recognized, with emphasis on educational television programming and tele-education networks. The use of communication satellites for telemedicine and disaster preparedness and relief was also emphasized.

40. In the area of space science, short courses and symposia were recognized as providing a vital mechanism for exchanges of information between scientists from developed and developing countries. Recommendations also called for a greater exchange of information and experience through meetings of regional professional organizations and scientific periodicals. Short courses and symposia were also important for the planning and development of cooperative activities based on a sharing of specialized facilities and expertise.

41. Specific proposals for specialized training courses in space science included satellite geodesy, upper atmosphere physics, astronomical observation techniques and design of instrumentation for ionospheric experiments and sounding rockets.

B. Long-term education

42. Recommendations relating to long-term education were aimed at developing national research, development and applications capabilities in satellite remote sensing, meteorology and communications. While there was a recognized need for specialized and advanced education at institutions in developed countries, proposals focused on the establishment or strengthening of regional and national facilities in developing countries providing in-depth education and training for scientists, engineers, technicians, managers and policy makers. One important mechanism identified for promoting education in space science, technology and applications was the introduction of space-related materials into existing university curricula at both undergraduate and graduate levels.

43. Particular attention was given to proposals for establishing or strengthening regional training centres with the assistance of the United Nations and the specialized agencies. It was recognized that educational programmes in developing countries could better concentrate on technology and applications that take into consideration the special environmental, economic and social factors of developing countries. Long-term education was viewed as a means to create a national core group of experts that could accelerate operational use of space technology and applications. Improved access to opportunities for long-term education was seen as requiring expanded fellowship programmes for developing country participants in the fields of remote sensing, meteorology, communications and space science.

44. In the field of remote sensing, education and training were seen as ongoing requirements that must meet both the immediate needs for individuals trained in applied remote sensing and the longer-term needs for research and development (R and D). It was therefore suggested that a long-term course might consist of a shorter basic course, perhaps two to three months in

length, followed by more specialized courses for six to nine months, as well as overseas training in more advanced subjects. Some recommendations stressed the importance of on-the-job training for operational applications of remote sensing for such purposes as agricultural inventory, ecological monitoring, drought warning, forest inventory and mineral exploration. Long-term educational requirements were also identified in technologies such as data-processing, image analysis and system maintenance.

45. While satellite meteorology is largely operational, there is a need to improve education in the field. Recommendations called for strengthening the existing national and regional training centres in order to meet the growing need for specialists. Specific priorities identified for long-term education included courses in the interpretation of satellite images for agrometeorological applications, courses on the analysis of radar images and the use of INMARSAT services for distributing information to maritime users.

46. Because meteorological satellite technology is operational and the data-reception, processing and interpretation systems are generally low-cost, it is an appropriate space application for integration into educational programmes at the graduate level at universities, including courses on the planning, operation and management of weather satellite receiving stations as well as image-processing and interpretation. It was also recommended that courses be offered in the applications of meteorological satellite data to oceanographic studies.

47. In the field of satellite communications, recommendations for long-term education focused on courses in the design, construction and operation of satellite communications systems and on the educational applications of satellite broadcasting. Specific recommendations for courses included the planning of satellite telecommunications networks, operation and control of national satellite systems, construction of satellite-receiving antennas and integration and operation of Earth stations. It was recommended that national or regional centres for telecommunications electronics, computers and teleconferencing should be developed and that training should take place in such centres. National institutions responsible for satellite communications should develop R and D laboratories that can provide effective support to educational programmes.

48. Recommendations endorsed the use of satellite broadcasting for improving national education systems. It was recognized, however, that educational systems are complex social institutions and that technology must be adapted to the existing infrastructure. The development of an educational broadcasting programme required a major effort for programme production based on a sound understanding of the audience and the educational purposes to be served. It was recommended that a country establishing an educational broadcasting system should initiate a major human resource development programme in the field of educational programme production, including training of studio technicians, programme producers and television teachers.

49. To facilitate business communications through a national satellite system, it was recommended that education and training be provided for establishing and operating teleconferencing capabilities. Other important business communication services that can be effectively provided by satellite include facsimile services and electronic mail.

50. In the area of space science, recommendations for priority areas for long-term education included astronomy, geophysics, experimental astrophysics and ionospheric research, including the use of sounding rockets. Recommendations also called for the integration of basic space science into curricula for undergraduate and postgraduate studies. Regional institutes for space science, established or strengthened with United Nations support, could play an important role in supporting education in space science.

C. Information, studies and technical advisory services

51. UNISPACE 82 recommended the establishment of an international space information service, initially consisting of a directory of sources of information and data services, but no new budgetary resources were made available for this purpose. Efforts have therefore been made within existing resources to expand the information services of the Outer Space Affairs Division. The work of the Division in this area has been reported annually to the Committee on the Peaceful Uses of Outer Space and its Scientific and Technical Subcommittee and has been reviewed by those bodies. The workshops, seminars and meetings of experts organized as part of the United Nations Programme on Space Applications have also considered the needs of developing countries for information services and have made recommendations as to how those needs might best be met by the United Nations.

52. The recommendations for information services emphasized the need to improve the exchange of information between countries, particularly for developing countries. An important means for this purpose is the use of on-line database services for the collection, storage and distribution of information and data on space science, technology and applications. The publication of directories of information sources was also considered important. The areas in which requirements for information were identified included education and training programmes, research facilities, data sources, equipment and literature. It was recognized that different countries needed different kinds of information services, and in particular that the needs of countries with substantial space infrastructure could be quite different from the needs of countries with no space facilities. These different needs would have to be taken into account in the development of an international information service.

53. It was recognized that an information service required more than simply a central office. Recommendations therefore emphasized the establishment of focal points at the national and regional levels which would gather and transmit information between a central facility and national agencies. It was also recognized that non-governmental agencies, in particular international

and regional scientific associations, performed valuable functions in the exchange of information.

54. While seminars and conferences provided important means for exchange of information, computerized databases providing continuing world-wide access from remote terminals were essential to low-cost, regular access to information. Such electronic information services can provide rapid and current information on data availability and characteristics, as well as bibliographic information on the latest scientific publications on specific topics. It was therefore recommended that the United Nations gain access to such electronic data services and databases. As part of such an information system, an electronic bulletin board could promote the exchange of information on cost, availability, operation and maintenance of equipment for image-processing, aerial photography and other activities.

55. The establishment of databases for specific regions was also recommended at regional seminars and workshops, in particular in the region of the Economic and Social Commission for Asia and the Pacific (ESCAP). ESCAP member States recommended the establishment of a central data bank to store data and information on activities in the region as well as from other countries and agencies. This central data bank would be computerized and linked through communication satellites and be accessible to member States through remote terminals.

56. The publication of directories was also emphasized as an effective way of disseminating cumulative information on the availability of space data, facilities, programmes and resources. Other useful subjects for directories would be education, training and research programmes and existing international, national and regional information systems.

57. In the field of remote sensing, a directory should provide information on the agencies and institutions acquiring and distributing remote-sensing data globally, procedures for ordering digital and analog imagery, descriptions of remote-sensing systems and data analysis equipment and availability of literature on various remote-sensing applications. A directory could also provide detailed information on the disciplines covered in the archives of each remote-sensing facility and information on gaining access to the information archives. Particular requirements for information were identified in the areas of agriculture, including crop statistics and mineral resources.

58. In the area of remote sensing there were also recommendations for an information service to provide regional and national training centres with information on availability of assistance. The information service should encourage literature exchange among developing countries and between developed and developing countries on a systematic basis. It could also support the establishment of a special collection of scientific and technical information relating to the proper management of natural resources.

59. A number of recommendations expressed ongoing concern over availability and continuity of remote sensing and meteorological satellite data, noting

that continuity of satellite systems and availability of data-processing systems were essential to the optimum utilization of remote sensing. It was recommended that efforts continue to establish data receiving stations to ensure that all countries had access to adequate data. While these recommendations applied primarily to remote-sensing and meteorological data, there was also a concern that scientists from all countries should have access to data from space research. It was felt that an international information service could encourage all remote-sensing satellite and ground system operators to make an effort towards the standardization of formats of data and catalogues. It was recommended that United Nations agencies should promote the development of arrangements to ensure continued access to satellite data at reasonable costs. It was suggested that an international committee, such as the Committee on Earth Observations Satellites (CEOS), might prepare a booklet identifying the compatibility of existing remote-sensing software packages and various hardware systems.

60. In the fields of meteorology and oceanography, it was generally recommended that States cooperate to facilitate the exchange of information on meteorology and marine-related affairs. One method proposed was the appointment of a national focal point in each region to collect information on all national marine remote-sensing and other space technology applications, including details of existing national facilities. Arrangements could be made for these focal points to exchange information on a regular basis. There were also recommendations for a service to provide information on hurricanes and cyclones to countries particularly vulnerable to such events. Information could be gathered on a regional basis through regional and national space institutions and distributed to disaster warning and relief agencies.

61. In the area of communications, an international information service could provide important information on satellite communications systems and technology suitable for particular regional and national needs. The most urgent requirements were for information on the characteristics, costs and maintenance requirements of reception and signal processing equipment, particularly relating to small and low-cost systems. A particular need was identified for the dissemination of information on satellite communications for education, either for academic and research institutions or for basic education needs. Access to electronic information services and databases was viewed as an important means to enhance the productivity of the academic and research communities in developing countries.

62. In the field of space science, the high price of scientific journals posed difficulties for researchers needing to keep up with the latest developments. Recommendations for making current information more available to developing country space scientists included arranging for reduced subscription rates to journals and creating national, regional or international clearing-houses for information and data. The requirements identified by space scientists included information on new research initiatives and possible collaborators in research projects.

63. In addition to information services and directories, the publication of technical review studies can also serve to disseminate information on space science, technology and applications of general interest. However, since the Committee on the Peaceful Uses of Outer Space and its subsidiary bodies provide direction to the Outer Space Affairs Division on the priority of studies to be undertaken, the seminars and workshops of the United Nations Programme on Space Applications were not given a mandate to request the Division to undertake specific studies. None the less, a number of topics were recommended as priority topics for study at the regional or national level, including studies on the use of satellite radar systems, the use of satellite observations for predicting dangerous storms and the use of remote sensing for fisheries. Concerning the use of communication satellites, there was a recognized need for studies on low-cost satellite communication techniques that could substitute for conventional television signals for educational broadcasting, telemedicine and other social communication services. Another recommendation was for an analysis of the possibilities of using elliptical orbits for communication satellites and of removing communication satellites from the geostationary orbit at the end of their operational lifetime in order to minimize the congestion of the orbit and to ensure its efficient use. It was recognized that such studies could play an important role in making national authorities aware of the contributions that space science, technology and applications could make to national social and economic development.

64. There were a variety of recommendations calling for the United Nations to provide technical advisory services to developing countries for regional and national space activities. The areas covered included the planning and organization of national space programmes, the evaluation of existing facilities and programmes, the development of information systems, the strengthening of institutional resources, the identification of suitable activities for a particular country or region, and the development of training programmes and educational curricula. Requirements for advisory services were also identified for designing and evaluating applications projects in remote sensing, meteorology and satellite communications. It was generally felt that such technical advisory services could assist States not only in establishing national programmes, but also in participating in regional and international cooperative programmes.

65. In the field of remote sensing, many of the recommendations focused on the establishment of national remote-sensing centres, including education and training programmes and applications assistance facilities. Requirements for expert advisory services were also identified in such specialized areas as data- and image-processing, geographic information systems, land-use classification techniques, crop-yield prediction techniques in mixed cropping areas, ground survey methods and aircraft remote sensing. It was suggested that the United Nations might develop demonstration packages designed for particular geographical and climatic conditions, for example for areas of persistent cloud cover. In cases where the requirements for advice exceeded the capacity of the United Nations, a directory of consultants might be developed.

66. In the area of meteorology, priority subjects for advisory services included establishing satellite receiving stations, evaluating existing meteorological satellite facilities, and the development of a network of automatic data-collection platforms. Meteorological applications for which advisory services were needed included tropical weather forecasting, rainfall estimation, atmospheric temperature-profiling, and the measurement of high-altitude wind velocity.

67. In the area of satellite communications, the requirements for technical advice was primarily in the area of low-cost community receivers and low-cost power systems for areas without electricity. There were also requirements for technical advice on network planning and systems operation.

68. In the area of space science, technical advice was needed for the development of research projects and for the development of sound national space science programmes that could involve a variety of disciplines. One particular area of interest was the use of sounding rockets for brief observations above the atmosphere.

D. Regional cooperation

69. While an increasing number of countries are developing national space programmes, it was generally recognized that regional cooperation still has an important role to play in supporting and supplementing national activities. The recommendations for regional cooperation emphasized the value of sharing specialized technical capabilities, educational facilities, expertise and data and information. Education was seen as a particularly important area of regional cooperation, and there were recommendations for regional centres for space science and technology education. Regional networks for sharing information could usefully be supported by national focal points in each country. It was also recognized that professional associations and other non-governmental organizations (NGOs) organized on a regional basis could make an important contribution to regional sharing of information and experience.

70. It was recognized that a variety of regional facilities and programmes already existed. These existing regional activities should be supported by the United Nations and other international organizations and, where necessary, new regional programmes should be developed and supported. There was agreement that the regional commissions had a central role to play in promoting and coordinating regional cooperation.

71. In the fields of remote sensing, meteorology and environmental surveys, recommendations for regional cooperation focused on the establishment or upgrading of satellite data reception, processing, distribution and archiving facilities. Since problems relating to the management of natural resources and protection of the environment were often common to more than one country of a region, regional survey and mapping projects were often valuable. For the same reason, regional information systems could often provide valuable support for national and regional resource assessment and management

programmes, as well as providing a means of transferring this new technology into national programmes.

72. In the field of oceanography, the international character of the natural processes involved made regional cooperation important for studies of such phenomena as marine pollution, oil spills, coastal erosion, fisheries management, marine climatology and delta formation.

73. In the area of communications, recommendations included the use of satellites for educational purposes, the establishment of coast Earth stations for maritime communications, the establishment of small integrated communications networks for regional disaster-warning for cyclone-prone regions, regional use of the SARSAT/COSPAS search and rescue satellite tracking system as an effective tool for saving lives, and the planning, acquisition and operation of regional communication satellite systems.

74. In the field of space science, given the cost of space research facilities and the international nature of most scientific research, regional cooperation through the sharing of equipment and information was seen as especially important. It was suggested that consideration be given to the establishment of regional institutes for basic space science.

IV. CONCLUSIONS AND RECOMMENDATIONS

75. The above survey of the implementation of the UNISPACE 82 recommendations and the recommendations emerging from the activities of the United Nations Programme on Space Applications organized since the Conference indicate that the general thrust of the UNISPACE 82 recommendations still correspond to the priority needs of developing countries. The survey reinforces the conclusion of the previous study on the implementation of the UNISPACE 82 recommendations 2/ that the United Nations has made efforts to implement, at least in part, virtually all of the UNISPACE 82 recommendations addressed to it.

76. The above survey and analysis also reinforce the previous conclusion that, owing to the limited resources available to the United Nations for the implementation of the UNISPACE 82 recommendations, many of those recommendations have not been fully implemented and that many of the needs of developing countries are not being adequately met. With the growing economic importance of space technology and applications, the need for training, education, information and technical assistance has increased substantially since UNISPACE 82 while the resources available in the United Nations budget for such activities have been essentially fixed.

77. The important areas of space technology and applications identified by UNISPACE 82 are still generally the most important, but with some changes in emphasis. Remote sensing of natural resources and satellite communications and broadcasting have remained the two most important applications. The uses of space technology for monitoring the global environment and for disaster

warning and relief have increased substantially in importance during the past nine years, while space manufacturing and the development of large-scale space structures have not developed as rapidly as was foreseen in 1982. While most of the UNISPACE 82 recommendations with respect to the technologies and applications of priority importance to developing countries are thus still valid, the planning and organization of specific activities must take into account the recent evolution of the technologies, applications and developmental priorities.

78. A full implementation of the UNISPACE 82 recommendations in order to meet the priority needs of developing countries as they evolve would require the expansion of United Nations space applications activities. The analysis of the recommendations arising from the activities organized since 1982 indicates that the current range and orientation of activities, including short-term training, long-term education, information services and technical advisory services, generally correspond to current needs of developing countries. There are, however substantially greater needs in all of these areas than can be met with the resources currently available.

79. Concerning short-term training, the major factor limiting the number of training courses, seminars and workshops organized by the United Nations Programme on Space Applications is the financial resources to support transportation and subsistence for participants and speakers from developing countries. The funding available for the Programme from the regular budget, almost all of which is used for short-term training activities, provides only a fraction of the financial resources needed for these activities. A major priority for more complete implementation of the UNISPACE 82 recommendations might therefore be additional voluntary contributions in the form of organizational and financial support from host or donor countries or organizations for short training activities.

80. While it is desirable to have some training activities in developed countries in order to expose participants from developing countries to advanced facilities, it appears most desirable to organize basic training in developing countries whenever possible, both to focus the training on the practical needs of developing countries and to increase the number of people from developing countries who can participate within a given budget. The organization of an activity within a developing country also gives visibility to and promotes the space activities in that country. However, while developing countries can generally provide the basic facilities required for a short training course or seminar, they are often not able to provide the funds necessary for international travel. The most important form of support for expanding and improving United Nations short-term training activities would therefore be additional financial support from developed countries for the organization of activities in developing countries.

81. The organization of a training activity involving a substantial number of speakers and participants from many different countries and organizations presents a variety of organizational difficulties. While the lessons learned from each activity are always used in planning and organizing future

activities, this learning process is most effective when the same organizers are involved in subsequent activities. For this reason, a series of activities organized annually or biannually in cooperation with a particular host or donor agency can often be more efficient and effective than a series of more ad hoc activities. While individual training courses and seminars on specialized topics will continue to be important, a priority for expanding the United Nations Programme on Space Applications within the existing budgetary and human resources might be the organization of more series of annual or biannual short training courses or seminars by particular host countries and organizations. This would require new commitments from Member States and international organizations to support such activities on an ongoing basis.

82. In the area of long-term education, the United Nations Programme on Space Applications has arranged for fellowships provided by Member States and ESA for advanced study in their universities and space institutions. The Programme has no financial resources from the regular budget for such fellowships and is entirely dependent on donor countries and institutions for this activity. The number of fellowships offered in 1991 through the United Nations was lower than that provided in previous years owing to the unavailability of new fellowships following those previously provided by the USSR. There is therefore a need for new offers of fellowships just to maintain the number previously provided. An expansion in the number of fellowships for long-term education would require yet additional offers from other countries and organizations.

83. In the case of long-term education, as in the case of short-term training, there is a particular need to increase the availability of educational programmes and facilities in developing countries. While fellowships for long-term study have been provided through the United Nations Programme on Space Applications by two developing countries, Brazil and China, additional long-term education in developing countries should be a priority. For this reason, the Programme has been promoting the development of centres or facilities for education in space science, technology and applications in developing countries, including both specialized education on a regional basis and basic education on a national basis. As a first step, the Programme, in consultation with potential host countries, potential donor countries and the regional commissions, has been developing plans for regional centres for space science and technology education that would offer courses for university professors, instructing and assisting them in the introduction of remote-sensing technology and applications into existing university curricula at the national level. These centres could make a major contribution to the creation of indigenous capabilities in developing countries as recommended by UNISPACE 82. The support of both host countries in the various developing regions and of developed donor countries worldwide will be needed on a long-term basis if these centres are to be established and run successfully.

84. In the area of information services, the technological capabilities for rapid and low-cost exchange of information worldwide have, as foreseen by UNISPACE 82, increased very rapidly in recent years. The developing countries, however, have had difficulties in taking advantage of these new

capabilities. While UNISPACE 82 recommended that an international space information service be established in the Outer Space Affairs Division in order to promote the exchange of information for the benefit of developing countries, no resources have been made available for this purpose. A priority in this area might therefore be to improve the facilities of the Outer Space Affairs Division and of space programmes in developing countries to make use of existing electronic space information services, electronic mail and other international information and communication facilities available through personal computers. Such facilities could be provided through voluntary contributions by developed countries and space agencies, particularly those operating computerized space information systems.

85. In the area of studies, the Outer Space Affairs Division has been carrying out and submitting to the Committee technical studies on topics identified initially in the UNISPACE 82 report and more recently by the Working Group of the Whole. The Division, within its existing resources, is capable of conducting such studies at the rate of about two to three studies per year. Given that the results of these studies generally remain valid for several years, this rate appears to be sufficient to meet the priority needs of Member States for this sort of information. Any substantial increase in the number of studies carried out would require additional technical personnel. Since the UNISPACE 82 report is no longer a fully adequate source of priority topics for study, it would seem appropriate for the Scientific and Technical Subcommittee, perhaps through its Working Group of the Whole, periodically to review the list of priority topics for studies to be carried out by the Outer Space Affairs Division within existing resources.

86. In the area of advisory services, the Outer Space Affairs Division has no budgetary resources allocated for that purpose, but has provided advice to Member States on request to the extent possible within existing resources. Any major expansion in this area would require additional technical personnel and financial resources. Improved access to existing space information systems and international information exchange networks would allow some expansion of these activities with a very modest increase in resources, perhaps through voluntary contributions in the form of equipment and arrangements for accessing electronic information systems.

87. Concerning the funding of expanded activities, it should be recalled that the UNISPACE 82 recommendations called for a reorientation and expansion of United Nations space applications activities to be funded through voluntary contributions and a rearrangement of priorities within the available resources. Since 1982, the use of available resources has been reoriented in accordance with the priorities identified by UNISPACE 82, and some expansion of activities has been achieved based on voluntary contributions. While full implementation of the UNISPACE 82 recommendations would require an increase in the budget for space applications activities, a significant expansion could be carried out on the basis of additional voluntary contributions as indicated above.

88. In addition to the expansion of the existing activities, there is a continuing need to identify new activities and new approaches to the application of space technology for economic and social development and for the protection of the global environment. To be effective, such new activities and approaches must correspond to the recognized priority needs of developing countries, and must obtain sustained material support from the host country, from donor countries and from international organizations. This requires not just technical analyses and recommendations by experts, but political commitments from Governments. The Committee on the Peaceful Uses of Outer Space, the Scientific and Technical Subcommittee and the Working Group of the Whole have a central role to play in identifying and supporting innovative approaches to international cooperation in space for the betterment of humankind.

Notes

1/ A/AC.105/483, annex II, para. 5.

2/ A/AC.105/451.

3/ A/AC.105/475 and Add.1.

4/ A/46/389.

5/ A/AC.105/497.

6/ A/AC.105/488.

7/ A/AC.105/482.

8/ A/AC.105/481.

9/ A/AC.105/480.

10/ A/AC.105/467.

11/ A/AC.105/466.

12/ A/AC.105/464.

13/ A/AC.105/502.

14/ A/AC.105/503.

15/ Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 9-21 August 1982 (A/CONF.101/10 and Corr.1 and 2).

Notes (continued)

16/ A/AC.105/478.

17/ A/AC.105/474.

18/ A/AC.105/468.

19/ A/AC.105/492.

20/ A/AC.105/472.

21/ A/AC.105/477.

22/ A/AC.105/490.

23/ A/AC.105/500.

24/ A/AC.105/451, paras. 8-23.

25/ A/AC.105/456, annex II, para. 6.